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Journal of the Society of Arts.

FRIDAY, NOVEMBER 28, 1856.

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SECOND ORDINARY MEETING.

Wednesday, Nov. 26, 1856.

The Second Ordinary Meeting of the One Hundred and Third Session was held on Wednesday, the 26th inst., Col. W. H. Sykes, F.R.S., Chairman of Council, in the chair.

The following Candidates were balloted for, and duly elected :—

Anthony, Charles.
Gilman, William Anthony.
Lefevre, George Shaw.

The following Institution has been taken into Union since the last announcement:—

424. Northowram Mechanics' Institute.

The following Colonial Institution has been taken into Union since the last announcement :—

Natal Agricultural and Horticultural Society.

The following Schools have been taken into Union since the last announcement :—

Birmingham, Bristol-road School.
Making Place Hall (near Halifax) Academy.

The Paper read was :—

INDIAN FIBRES, BEING A SEQUEL TO OBSERVATIONS "ON INDIAN FIBRES FIT FOR TEXTILE FABRICS, OR FOR ROPE AND PAPER MAKING."[*]

By J. Forbes Royle, M.D., F.R.S.

In proposing to re-introduce the members of the Society to a subject which they so recently discussed, I feel that some apology is necessary, the more particularly as it is not one to which I myself am specially wedded. Indeed, in Paris, I promised our Secretary a Paper on the Oils and Fatty Substances of India, a promise which I hope yet to be able to redeem. An increased supply of materials for cordage, clothing, and paper-making, is, however, not an unimportant one, as I have endeavoured to show; and though my paper on this subject was written at the request of the Council, and that on paper-materials at the call of the Board of Trade, and both in consequence of the anticipated deficiency of the ordinary sources of supply, I had long before endeavoured to have turned to account the true hemp plant which grows in such abundance in some parts of North-Western India, and had, at a still earlier period, thought, like so many others, that as India grows and exports such large quantities of linseed, there must be a corresponding production of flax, and, as none was collected, there must be proportionate waste.

My attention has been directed to these fibrous substances in a greater degree than to some other Indian products, because India appears to me to be pre-eminently a country for fibres, and because I believe that a great mass of valuable material, which now yearly runs to waste, may more readily than almost anything else be turned to profitable account. In the first place, the vegetation of the country is characterised by a teeming abundance in species of plants known to abound in fibres. Thus, without enumerating the gigantic grasses, the *plantain* and the *marool* yield large quantities of white fibres. Among the palms, in addition to cocoa-nut fibre, we have the black *Ejoo* fibre, remarkable as well for strength as for incorruptibility when exposed to wet. As the lime tree yields Russian bast, so the jute and its congeners of the same family are now equally indispensable to our manufactures. As the leguminous and malvaceous classes of plants include several groups, of which numerous species abound in fibres, so do also the *Asclepiads* and the nettles; combining to afford us any variety of fineness and of strength which we can expect, or I may almost say wish for in fibres. The climate, moreover, is favourable for the growth of these fibre-yielding plants; for as most of those to which I have to allude belong to the indigenous flora of India, their period of growth is during the rainy season, when there is suitable heat and abundant moisture ; thus is secured the rapid growth of the parts of vegetation in which almost entirely these fibres abound. As the rainy season comes to an end after three, or in some parts, four months, there is usually fine weather for the separation and preparation of these fibres. In these operations, however, I believe the natives may very profitably be assisted with some cheap machinery, and be taught improved and yet simple methods of preparing their fibres for market. There is, moreover, great abundance of unoccupied land as well as of cheap labour, and easy accessibility, either by sea or river carriage, to the places where the fibres chiefly abound. It has no doubt been in consequence of the suitableness of all these essentials that the import of fibres from the East has so rapidly increased. Thus, as I have already quoted from McCulloch's Commercial Dictionary :—

Hemp Imported into the United Kingdom.

	1831.	1851.
From Russia ....cwt.	506,803	672,342
From British India..	95,472	590,923

There was a falling off in 1852 and 1853, but an increase in 1854 and 1855, the imports being :—

	1854.	1855.
Hemp.....................	125,951	69,464
Jute.......................	443,558	520,741
Other fibres	741	963
	569,250	594,068

I am indebted to Sir Emerson Tennant for the following return :—

An Account of the importations of Hemp in the nine months ended 30th September, 1856, distinguishing the Quantities imported from British Territories in the East Indies.

	Quantities Imported into the United Kingdom in the Nine Months ended 30th September, 1856.				
	From British Territories in the East Indies, exclusive of Singapore and Ceylon.	Ceylon.	Singapore,	Other Countries.	Aggregate of the Importations.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Hemp, dressed	593	...	...	13,025	13,618
——— undressed	37,777	...	209	342,165	380,151
——— tow, or codilla of hemp	...	...	...	10,095	10,095
——— Jute......................	529,817	...	...	16,311	546,128
——— Other vegetable substances of the nature and quality of undressed hemp	893	1,431	...	1,876	4,200
	569,080	1,431	209	383,472	954,192

JOHN A. MESSENGER.

Office of the Inspector-General of Imports and Exports,
Custom-house, London, Nov. 22nd, 1856.

The soil and climate are also favourable to the other plants which have been introduced from other countries;

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[*] See *Journal of Society of Arts*, vol. ii., p. 366.

thus, the pine-apple now abounds in Assam and in the Indian islands, also in Pegu: the agave or American aloe is quite at home in the comparatively dry climates of the Deccan and of Mysore. The flax plant is itself extensively cultivated in the plains, but only on account of its linseed, as also the true hemp plant; the latter for the intoxicating secretions of its leaves.

By some it may be asked, why, if so favourable to the production of fibre, does not India produce larger quantities, or a better quality of cotton. The question might be answered by stating that cotton is not fibrous but cellular tissue. But a more proper answer would be, that cotton is a production of the fruit and not of the stem or leaves of a plant; and it does not follow that a climate which promotes the growth of certain parts of vegetation is also favourable for the maturation of fruit; indeed, the converse is not unfrequently the case. Therefore, though the seasons may be well suited for all the purposes of indigenous species, they may not be so for those which are foreign to the soil. This is the case with the American cotton plant; for it is not the short-stapled Indian cotton which our manufacturers require, but American cotton grown in India. Though this grows vigorously in most parts of India during the rainy season, it is unable, with its short roots and broad expanded leaves, to bear the transition from the moisture of the rains to the comparative dryness at their conclusion. Failure has therefore ensued in many places, but in others, as the district of Dharwar, there are 60,000 acres under cultivation with American cotton; but there the plant has the advantage of the influence of the two monsoons. I believe it will be possible in other districts, as the irrigation canals come fully into operation, so to moderate the transition from moisture to dryness as to allow of the full ripening of the fruit, and, therefore, of the formation of good stapled cotton.

To return, however, to our subject. I have myself been induced to return to it, because some new fibres of good quality, and old ones from new situations, were sent to the Paris Exhibition. Much additional information has been obtained on some points, and ample confirmation of the views I formerly promulgated. I have been encouraged also to proceed with this subject, from the attention which it has excited, and from the numerous inquiries which continue to be made of me respecting these Indian fibres: likewise from my having been informed from the best sources that in the busy hives where the fibre manufactures are chiefly carried on, they yet require still larger supplies, either of those which are in commerce, or of such as are most like them, and therefore, most easily substituted. I know, also, that several engineers are employed in ascertaining improved methods of separation and of preparation, not only of fibres in general, but of these in particular. And, though last, not the least important result will be, that improved information cannot fail to be useful to some of our fellow-subjects of the East, who are, perhaps, apt to depreciate indigenous products; while some of them may be induced to grow or to use what is valuable in neighbouring districts (for some complain that there is no market even for a valuable product), while a few may perhaps be induced to send theirs in an improved state, in order to realise a higher price in the market.

Such investigations, though they may not appear practical, are, however, of great use in enabling the inquiring and intelligent manufacturer to become acquainted with the properties and probable quantities of new substances. The broker is able to say something more respecting them than that "they are unknown in the market," and therefore of no value. As a further consequence, the local merchant or capitalist abroad is able to purchase, or make advances on what there is some probability of selling at reasonable prices in foreign markets. Finally, the European planter or native cultivator is encouraged to grow or to prepare what appears to him of the greatest value, because it finds a local purchaser; for he has little or no knowledge of what is of value in the foreign market. Any one of the points of this circle of connections being omitted is sufficient, as has often been experienced, to put a stop to progress in a new course. Such inquiries are, moreover, of especial utility if carried on in connection with a Society like the present, where every subject has the advantage of being submitted to the examination of men who, by their scientific attainments and practical knowledge, are the best qualified to form a correct judgment on the value of unknown products or of the new inventions brought before them. For, as I before stated, it is only by the union of scientific principles with practical knowledge that any great results are, in the present day, to be obtained. For, if we rely upon the latter only, we may, sometime, when apparently proceeding at railway speed, be brought to a sudden, and occasionally disastrous termination by the neglect of some single point; while, if we rely upon scientific principles only, we may often be shunted off, though we can avail ourselves of legitimate modes for returning to the course we were wishing to pursue.

Having on a previous occasion, as well as in a separate work, dwelt on the great variety of Indian fibres, of which we now have a very extended display, it is not my intention either to enumerate or to describe the great variety of fibres which are, and may be, produced in India. But I propose rather to dwell upon those which are at present most worthy of attention, because possessed of superior qualities, or procurable in larger quantities, or because they are wanted by manufacturers in Europe for particular purposes. Therefore, I shall arrange my observations under the heads of the purposes to which different fibres are applicable, rather than under the names of each particular fibre,—thus:—

1. Basts and barks.
2. Platting and mat-making materials.
3. Cordage fibres.
4. Textile fibres.
5. Paper materials.
6. Adaptation of machinery for preparing fibres in India, and methods to be adopted for obtaining fibres in large quantities from India.

Basts and Barks.

Though I commence my observations with basts or barks, it is not because I think them of primary importance, for I am well aware that carriage and freight must operate against their being brought in any large quantities from such great distances; but still, some useful information may be elicited respecting them, and applied to other subjects. The bast now chiefly used is that employed for making Russia mats. Of these about 3½ millions were annually exported from Russia, and of them from 500,000 to 800,000 were brought to this country, selling for about £5 per 100; but gardeners have, for some time been in the habit of tying up plants with Cuba bast. The origin of this was, until lately, quite unknown. In describing the basts or inner barks of several trees which had been sent from Assam, &c., I stated, that among the Indian species of Grewia, as well as among the Malvaceæ, there were numerous bast-yielding plants. I specially mentioned, as those used by the natives, the bast of *Hibiscus arboreus*, or *liliaceus*, *Sterculia villosa*, and others. It is curious that Sir W. Hooker, in a late number of the *Journal of Botany*, has ascertained that Cuba bast is produced by a West India tree named *Hibiscus elatus*,* and which appears to be nothing more than a variety of *Hibiscus liliaceus*; that is the very same species as that I have just mentioned as one of those of which the bast is in use by the natives of India. Dr. Lindley, in the *Gardeners' Chronicle* of Nov. 8, hopes "that this useful material may now be prepared in our colonies, and sold at a lower price than it bears at present."

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* *Journal of the Society of Arts*, Vol. IV., p. 786.

Nothing would appear to be more easy than to provide the same, or an efficient substitute, if we look at the various basts which have been sent from different parts of India, as, for instance, that of the *Beemul*, from as far north as the Deyra valley, and the *Butteah*, from the Assam valley. But, for the purposes of foreign commerce, those from Akyab, the seaport of Arracan, seem most desirable, as they are abundant, cheap, and easily divisible into fine, pliant, and knot-tying fibres. Some sent to the Chiswick-gardens of the Horticultural Society were favourably reported upon. The retail price of several, even when twisted into rope, in Akyab, is one rupee per maund, that is, three shillings per cwt. For this sum, therefore, they might be put on board ship; and if bast, even when twisted into rope, we may ask why not paper stuff at about the same sum. Various experimental fibres have been sent from Calcutta for £3 and £4 per ton for freight. The rapidity with which the exports from Akyab have increased is something remarkable. The value of exports in—

	United Kingdom.	To all parts of the world.
1854-55 was ...	Rs. 3,568,169 ...	5,357,801
1855-56 ,, ...	8,112,408 ...	10,300,113

The western coast of the peninsula of India being also moist in climate, is equally favourable for the growth of bast or fibrous material. Several such have been sent from Travancore, for which Cochin is the most convenient port for shipment. As an instance, I will only mention the bark bags which are employed for holding rice. These are formed of the bark of *Antiaris saccidora*, which is common in the jungles of Canara, near Coorg, and Travancore.

These bags are made by cutting a branch corresponding to the length and diameter of the sack wanted. It is soaked a little, and then beaten with clubs until the inner bark separates from the wood. This done, the bark is turned inside out, and pulled down, until only a small piece of it remains attached to the wood, which is to form the bottom of the sack, and from which the remainder is then sawn off. If we look at the immense mass of the fibrous matter, and the white colour of the inner layer, and how the fibres of the several layers cross each other, one cannot but be struck with the apparent fitness of the whole for being beaten into half-stuff for paper-makers; and regret that so much valuable material must be lost, when only the thick part of the branches is made use of for making these sacks for holding rice.

Some bast has been imported from Arracan by Major Lyell, but it is difficult to find a purchaser for a new article. It is, however, of good quality, as the layers, when separated, tie knots well.

One ton of Gharoo fibre, or rather bast, has been sent from Malacca, to have its value ascertained, as large quantities could be procured there. The gharoo is known in commerce; but it is the wood of this tree in its decayed state, which is well known as the high priced *lignum aloes*, so valued as incense. The bast has been sent both in its twisted and untwisted state. It is a mass of lustrous fibre, of great tenacity.

Platting and Mat-Making Materials.

These being, like the basts, bulky material, and of low price, cannot be expected to pay the expenses of freight, therefore, few observations will suffice to show the abundance of materials. India has long been famous for its mats, as the people produce some of the finest known, which are often to be admired for the elegance of the patterns with which the material is coloured and woven. Mats being suitable both for sitting or sleeping on the ground, and especially pleasant in hot weather, are made of all qualities and prices for different classes of society. Thus, some are made of grasses, and others of the Bulrush, in different parts of India; some of the leaves of the Kaldera bush or screw pine; many of the Cadjan or dried leaves of the Palmira tree; some stiffer in nature, but useful for a variety of purposes, of split bamboos. The most famous mats are, however, made of the split *Cyperus tegetum*, in Bengal, and of the same or a similar species, *C. textilis* in the Indian peninsula, but the kind especially called *seetul pateer*, or cool mats of Bengal, are made of the *Phrynium*, now *Maranta dichotoma*. This, as well as the former, is well adapted for platting of all kinds.

Twine and Cordage Materials.

Though I have arranged the several fibres under what are apparently useful heads, it is evident that the arrangement is an arbitrary one, for some may be used for each and all other purposes to which such material is applicable. These are, therefore, arranged rather according to their present appearances than to what they may be ultimately brought, as there is no doubt that preparation will convert a bast into a cordage fibre, and a still more careful process, bring it to a state fitting it for the highest textile purposes.

Having before given a detailed account of the great variety of cordage materials procurable in India, I need not do more than refer to some of the new fibres, or to old ones from new situations, which were sent to the Paris Exhibition, and select those for remark which seem the most likely to become extended articles of commerce. In the first place, we have seen that the grass called *Moonja* is employed both on the Ganges and Indus rivers for tow ropes, and a kind of cotton-grass for making bridges in the Himalaya. Though coir rope is well-known, the black Ejoo deserves to be equally so, from its great strength and incorruptibility under water. The Pita or Agave, commonly called aloe, is used both in mines and for the rigging of ships in the New World. The plant has become common in, and is well suited to the dry parts of India. This is also indicated by specimens sent from different and distant parts of the country. Ropes made of it are coming into use among the natives, and the fibre might be obtained to a considerable extent. It has been said that it is liable to rot when exposed to wet, but this is not found to be the case in South America. Much will depend upon how experiments are made, for if the mucilaginous parts of fibres are not sufficiently separated, and a bundle of fibre or rope is macerated in a tub of water, or exposed to wet in a warm climate, fermentation will take place and decomposition ensue. All which would not be experienced if the fibre was cleaned in running water, and then exposed to wet and afterwards to dry or moist air. In experiments tried at Toulon, Calcutta and Madras, Pita ropes were found to possess great strength.

Pine-apple and marool fibres, though fitted for better purposes, have also been made into rope, and some of the former, made into a rope, 3¼ inches in circumference, bore 57 cwt., though the Indian Government require ropes of that size to bear only 42 cwt.

Manilla hemp is now well known as a fibre able to bear great strains, and its rope, therefore, is much used for the rigging of ships, as well as in warehouses. The plantain being, like it, a species of Musa, it has been supposed that its fibre might be turned to useful account, especially as the plant is grown in such vast abundance on account of its fruit, and the fibre is an annual refuse. There is no doubt that much useful fibre may be obtained from this plant, and of which cordage may be made, applicable to a variety of ordinary purposes, especially if carefully prepared, that is, without steeping in water, but by simple pressure and scraping. Indeed, a twelve-thread rope of plantain fibre, made in India, broke with 864 lb., where a similar rope of pine-apple fibre broke with 924 lb.

As it is desirable to know the quantity of fibre which may be obtained from a certain quantity of ground, we may refer to the results of experiments which have been recorded, though all require to be carefully reported:—

New Zealand Flax	1792 lbs. per acre
Moorva, or Marool	1613 to 3226 lbs. in two crop
Plantain	1800 to 2500 lbs. per acre.

It has been calculated that with appropriate machinery, in suitable localities, the expenses of obtaining such fibres ought not to exceed from £9 to £10, and that they might then be landed in England from £13 to £16 per ton.

The preceding observations refer to the fibre of endogenous plants, but those of exogens are equally, if not more valuable, for almost all the purposes to which fibres are applied. Already we have seen among the basts, a number of barks which have been merely stripped from trees and twisted into strong, and for many purposes very serviceable ropes. We have here a sufficient number of them to convince you of the abundance as well as of the goodness of such materials. But it would not be difficult greatly to extend the number, for several families abound in plants having barks possessed of similar properties. Besides these basts, there are numerous fibres which are sufficiently separated from each other to be twisted into yarn, and subsequently into ropes. They are all possessed of sufficient strength and flexibility to permit their being well fitted for ordinary, but some of them may be for any purposes to which fibres are applied. But I think it preferable to confine myself to two or three only of these fibres, in order that the attention of manufacturers may be concentrated on them, so that planters in the East may be induced to give their exertions to the extended cultivation and improved properties of those fibres which seem most likely to respond to the demands made on them for quantity or quality, or both combined in one.

I do not at present refer to the jute, of which so many thousand tons are yearly imported, nor to the sunn of Bengal, which has been so long used as a substitute for hemp. Of this the peculiarities seem to me to depend as much upon the mode of preparation as upon the peculiarities of the plant. But I would beg to call attention to two or three fibres which may or may not be produced by different plants, but which have been several times picked out by practical men as good substitutes for hemp, and perhaps also for flax.

These may be arranged under the head of the Brown hemp of Bombay. This, it is curious to note, is produced by two different plants: one, the Ambaree (*Hibiscus cannabinus*) or Deckanee hemp, and the other the Tāg (*Crotalaria juncea*) or Conkunee hemp. Though the fibre of this last plant, as prepared in Bengal, is totally different from that of the other, yet, as prepared in the west of India, there is a great similarity between them. This, I have already stated, is shown in fibres sent from Bombay on former occasions. It is found in two specimens sent from Sattara; one is the Ambadee (*Hibiscus cannabinus*), much used there for ropes, and the least troublesome to prepare, costing about nine pie per lb.; and the other is the Tāg (*Crotalaria juncea*), used both for sacks and ropes, but costing about 11 pie per lb. Both are well adapted for cordage, as is also the Janapa, the same *Crotalaria juncea* from the Malabar coast, which has always been famous for the excellence of its fibres.

The district of Canara, which, indeed, is only a prolongation of the same Malabar coast, has sent some specimens of fibre which have been much admired for the fineness, strength, and clean state of preparation of the fibre. They have been sent without any information respecting them. One is the *Naroo*, or the fibre probably of the *Crotalaria*, and the other is the Poondy naroo, perhaps the above *Hibiscus*. So, further down the same coast, we have the *Wuk* naroo, in Travancore, which might, even in the state in which it is sent, be used at once as a substitute for flax. That there would be no difficulty in obtaining this fibre in considerable quantities from Canara, is evident from a statement recently made by the collector of this district, that is, he has "a full belief that, if there should be a steady demand for this hemp for two or three years, it would become one of their staple products, instead of being cultivated in small quantities only for fishermen to make their nets and lines." He moreover adds, that there are thousands of acres unoccupied, but which are well fitted for the culture of this plant, as the soil is exactly similar to that of the places where it now grows. All the low land fit for rice cultivation has been long taken up. This is a district which runs for many miles along the west-coast.

The production of fibre of this quality is not confined to the western coast of the peninsula. Some equally good is produced in some other districts, for instance, the Janapa naroo of Ganjam, and the so-called hemp and flax from Goomsoor; and it has also been sent of excellent quality, long and well-cleaned, from Chota, Nagpore. This is very similar to Mr. Williams's Jubbulpore hemp, which I formerly showed, and as yielded by *Crotalaria tenuifolia;* and, though Jubbulpore is far in the interior, Mr. Williams sends it to Calcutta, and even to this country. Even still further in the interior, we have a very excellent specimen of the same kind of fibre from the Punjab, and which was sent as the packing of some large models from Lahore.

As these last localities are far in the interior, it might be supposed that there would be difficulty in procuring these fibres. There is, however, a very excellent one, which has been unaccountably neglected, as it may be obtained even in Bengal. That is the Dhunchee (*Sesbania aculeata*) which is cultivated there, and forms a coarse but strong substitute for hemp. Ropes made of it have the objection, for some purposes, of contracting. The price is usually under that of jute; in the interior about 3s. per cwt. Excellent specimens of Dhunchee rope have been sent from Calcutta; some, having been submitted to various experiments, has been so satisfactorily reported upon, that the fibre appears to me well worthy of being imported, as well as the fine specimens of what is here called Brown hemp.

We may now proceed to notice the new specimens of the true hemp, or *Cannabis sativa.* In my former lecture I called attention to what was considered one of the strongest of fibres, and which I called Kote Kangra hemp, as it was supposed to be the produce of the true hemp from the newly acquired portion of the Punjab Himalayas. From the representations made to them, the Court of Directors of the East India Company ordered that from five to ten tons, as convenient, should be sent to this country from Kemaon, the Deyra Doon, and Kote Kangra, it order that the cultivators might have some inducement to grow the plant, and that manufacturers here might become acquainted with the properties of the Himalayan hemp, so that it might become known to, and established in, the market here. The experiment has not, as yet, been very successful.

First, of 171 packages of hemp fibre received *viâ* Bareilly from the Assistant-Commissioner of Kemaon, it was reported by the master attendant in Calcutta, that the whole was more or less damaged from having been wetted by fresh water, so that one-third was entirely destroyed; but the rest having been carefully garbled, aired, and dried, was compressed into twenty-six bales. Of these twenty-three were in good order and three slightly damaged. Some specimens are here, and all will shortly be sold by Messrs. Noble.

The next import of this true hemp from the Himalayas, was grown in Mandoo and Kooloo, in the Kangra district. There was some difficulty in collecting it, in consequence of its being the first occasion, and therefore it was not ready for despatch until the beginning of the rainy season. Somewhere about two tons were sent down the Indus to Kurrachee, from whence it was forwarded to Bombay, all by water-carriage. Unfortunately this, like the Kemaon sample, got wetted, and therefore damaged in transit. It was, therefore, considered doubtful whether it was in a fit condition to send to England. Its quality, however, on being tested in Bombay, was found to be greatly superior to what was expected, and it was carefully sent in a cabin from Bombay, but not having been pressed, its freight has cost more than it was worth. It is valuable, however, as the first specimen that has been imported, and we have it here to judge of the probable value of this new source of hemp.

One important fact is mentioned in the correspondence, and that is, that fleets, instead of single boats, now navigate the Indus, and that the freight by them had been reduced from R. 1 2 to 10 annas per maund,* from Lahore to Kurrachee.

Textile Fibres.

In Mr. Yates's admirable work, entitled " *Textrinum Antiquorum*," there is a map of the ancient world, according to the raw materials principally produced in it for weaving, and it may serve to give an idea of the extent and variety of India to state, that it embraces all the raw materials which are considered to characterise the divisions of the ancient world. Thus, camel's wool and goat's hair in Sindh, sheep's wool in north-west India, and with hemp in the Himalayas, are all worn, as silk is in Assam, and cotton all over the plains of India. In addition to these, we might add a number of vegetable fibres used for textile purposes. Thus, jute, sunn, and ambaree, are three different fibres which are woven into cloth in different places. So the white fibres of the moorva, or Indian bow-string hemp, are woven into muslin-like fibre, so abundant in the jungly salt soils of the coast; this is still more the case with the pine-apple, which, from its fineness, and the abundance in which the plant occurs, is invaluable; for instance, in the neighbourhood of Singapore, and in the adjacent islands, there are said to be thousands of acres covered with this plant, and there the plant grows so readily, that the supply may be considered inexhaustible. It is named pigna by the Spaniards of the Philippine Islands, from the resemblance of its fruit to the cone of a pine tree. Hence the name of *pina* cloth, sometimes called *batiste d'ananas*, which we sometimes see richly-embroidered by the nuns in the convents of Manilla, Both names are interesting, the one as characteristic of the cloth, and the other of the plant which yields one of the kinds of fabric which is made and exported from the Philippine Isles, and which is characterised by its muslin-like character, though somewhat wiry in feel, and apt to become of a brownish hue. There is yet another kind of fabric which, unfortunately, is by some also called *pina* cloth, but which I cannot believe to be produced by the pine-apple, as the fibres are broader, softer, and have a lustrous appearance. I have been unable to obtain any positive information respecting the source of this fabric, but I believe it to be the produce of the same plant as that which yields Manilla hemp, for we are told that the plant called *Abaca* (*Musa textilis*), is grown to a considerable extent; that the outer layers yield fibre fitted for cordage, and the inner ones for weaving into fabrics, such as web cloths, which are described as having lustre, softness, and white colour. The fibres for fine weaving are rendered soft and pliable by beating them with a wooden mallet. I am further confirmed in the correctness of this opinion, from the fibres of the plantain, which is a species of of musa, when carefully prepared, having a glossy and silk-like appearance. Dr. Hunter found that all steeping in water is injurious, and that it is better to separate it by pressure and scraping at once, and the more carefully it is cleaned the stronger is the fibre, and more glossy. As I formerly dwelt upon the great importance of preserving the fibre of the plantain, which is so extensively cultivated for its fruit, which, if too abundant, we may preserve, when ripe, or prepare plantain meal from it before it is quite so, I believe that not only will the fibre be useful for cordage for ordinary purposes, but a part may be employed for textile purposes.

Though jute in the plains, and hemp in the Himalayas are both employed for textile purposes, we will next notice the attempts which have been made to produce flax in India.

Flax and Linseed.

Of the great abundance of the flax plant in India we have a sure proof in the increasing quantities of linseed which are yearly exported from India. Thus, in 1851, 93,814 cwt., and in 1854, 362,882 cwt., were imported into this country.

Many have thought that, as India produces so large a quantity of linseed, and no flax, there must be a great waste of useful material. There is no doubt some truth in the former statement, but not nearly to the extent that is supposed; for, in consequence of the mode of culture and the peculiarities of climate, the stem is short and branching, producing much seed and a little coarse flax, which is separated with difficulty, from the branching nature of the plant. The appearances, indeed, seemed so favourable, that a company was established by men acquainted with India: a Belgian cultivator, and Belgian preparer of flax, were sent to Bengal. Though flax was produced—said to be worth from £40 to £60—no permanent effect was produced, though it was said to have cost one experimentalist only from £12 to £15, and who ought to have succeeded, as he says that the expenses of cultivation were paid for by the seed; but others state that it cost £31 and £32 a ton. I cannot, however, think that which is done successfully in Egypt is impossible in every part of India. Indeed, I was of opinion that it might be successfully produced in Sangar and Nerbuddah territories, in consequence of the soil and climate being such as will probably suit the plant, deficiency of moisture being seldom complained of. But I have not heard the results of Mr. Williams' proposed experiments.

Some of the finest linseed having been produced in the neighbourhood of Saharampore, in 30 degrees of north latitude, and some flax which was grown from this seed having been highly thought of at Liverpool, it was determined to have an experimental culture under Dr. Jameson, who so successfully conducts the cultivation and manufacture of tea. Here there is a variety of climates, as in the plains at the head of the northern Doob, in the Door valley, and on the hills themselves.

The report has not been yet received, but in a private letter I lately received from him he stated that they had succeeded completely in the cultivation of the plant, but had failed in the separation of the flax. This is a thing that can be easily remedied.

The Agricultural Society of the Punjab first produced some flax in the winter of 1853-54. Samples of this having been sent to Calcutta it was pronounced to be the finest flax that had been grown in the country. The Indian Government having been applied to, authorised through the Society that prizes should be given for the largest area of land cultivated with the flax plant, and also the purchase of the entire crop of merchantable flax, as well as of the seed, at the current Bazaar rate; if no purchasers should present themselves. Directions were published and distributed, and preparations made for the reception of the large quantities of flax which were expected to be brought to Lahore. The Society was also authorised to rent some land, which was to be cultivated under their own inspection, and the flax prepared by a European who had had some practical experience of the preparation of flax in Europe. On application, some specimens of tools were sent over, as well as European seed, small quantities by the overland route, but the larger quantity by sea, and of different kinds, as Riga, Dutch, American, English, and Irish, purchased from the highly-respectable house of Wrench and Co., of London-bridge.

Among the results of this experiment, it is observed, in the Society's Report, "In the course of the experiments of the past season, both as regards cultivation and preparation of flax, numerous facts, of more or less importance, have been elicited. For instance, it is found that much, if not all, of the linseed of Central India bears a white instead of a blue flower, and that the seed also differs materially. Also, that the flax of suitable Indian localities, though from Indian seed, is capable, if properly sown and plucked at the right time, of producing excellent fibre, and with a moderate degree of manipulation." This, indeed, seems to be the only proper course to pursue, for it would hardly be possible to establish any extensive culture, if it was necessary to import seed from Europe.

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* The maund is considered equal to 82lbs. The rupee is equivalent to 2s. It contains 16 annas, each anna being 12 pie.

The attempt to induce the natives of the Punjab to cultivate linseed on a large scale and to produce flax, seems to have been as successful as could reasonably have been expected. For the breadth of land under culture increased from 3,453 acres in 1853-54 to 19,039 acres in 1854-55. But though the Government had offered to buy all the seed, if no other purchasers offered, yet of the 150,000 maunds of seed which were calculated to have been produced, only 11,300 maunds were brought to be purchased by Government, the rest having been bought up by native merchants. The net outlay by Government up to January, 1856, having been Rs. 29,657 15 7, and the year's proceeds Rs. 33,150 14 3, giving a net surplus of Rs. 3,444 8 4. Such a favourable result, in the first year of an experiment, was, no doubt, due in part to the unusually high prices prevailing during the war with Russia. The seed was, no doubt, of a good quality, as is most Indian linseed, from the quantity of oil it yields.

Some of the natives of Punjab having been in the habit of separating fibre flax on their own account, and so large a breadth of land having been sown, on the government engaging to purchase all the seed and also fibre that was produced, if no other purchaser offered, it was expected that a very large quantity of fibre would have been produced. Preparations were made by the Agricultural Society to receive it, and their Secretary wrote to different Chambers of Commerce, informing them of the expected out-turn of flax from this new locality. These anticipations were not, however, realised, for the fibre which was brought in was small in quantity, though some of it was of good quality. The straw brought in amounted only to 2,365 maunds, some of it green, some dry; about half had to be thrown away, and only 110 maunds of merchantable flax were produced, and this was bought by Messrs. Harton, rope-makers, for eight rupees a maund, and sent down to Calcutta. Indeed, it was hardly to be expected, that men who had been in the habit of thin sowing a plant for seed, would all at once sow it thickly enough to produce good fibre, especially as prizes were to be given for breadth of culture. I myself had in some measure anticipated this result, for I stated, "But while the best method of culture will be ascertained by the Society, on their own cultivation, it is feared that the length of stems required (3 feet 6 inches) will exceed much of what may be grown by the natives (Indian Fibres, p. 196). There is, however, a favourable prospect of the successful culture of fibre in the Punjab. None of the specimens of flax grown have yet reached the India House. But I have a small sample of flax grown by Mr. Wagentreiber, in Upper Assam, and another sample sent by the Dundee Chamber of Commerce, which is said to have been prepared from straw grown 800 miles from Calcutta (though it is not said in what direction). The Directors consider that fibre, of the quality of the sample, would be useful in the manufactures of Dundee, could it be laid down in this country at a price not exceeding £30 a ton; and yet in the report which accompanied this article, the straw is said to be intrinsically a very poor article, and the quality of the finished sample also indifferent; but, nevertheless, it is a marketable article. Considering how frequently inquiries have been made to grow flax, even though it should be of a coarse quality, it appears surprising to me that some of the easily grown fibres of India should not have been employed as substitutes for flax. This is probably owing to the fibres being sent by the natives in a roughly prepared state to market. For there is no doubt that the fibre, when ultimately divided, is fine and also strong enough, as we may see in this specimen of the Wuckoo fibre, from Travancore, and was formerly seen in the fibres prepared by Mr. Dickson. This is still more conspicuous in the fibres which have been prepared by Mr. Pye, and which I gave him a few days ago in the rough state in which they were sent from India. The red bast from Pegu has been converted into a good fibre, and we see a part has been bleached and is almost white.

Mr. Pye's other specimens were, he informs me, prepared from the commercial Bombay hemp; I hope Mr. North will give us some information respecting this process.

Besides these, there is another set of fibres, which I will not particularise, for they are too numerous, but they are remarkable for length, softness, and silkiness; indeed, in many respects, they resemble fine jute, but they are usually stronger. These belong chiefly to the genus Hibiscus, some of which are cultivated on account of their edible fruit. Several have been sent from Assam, others from Chota Nagpore, and Sambhulpore, from Bijnour and from the Deyran valley. The Urena, from Pegu, but a weed in most parts of India, yields a soft jute-like fibre, which, as well as another from Tenasserim, may be used for flax. Others have been sent from the opposite coast of India, that is, from Canara, whence, we have seen, a fine kind of hemp is produced. Some of these are well worthy of cultivation. Dr. Roxburgh, 50 years ago, recommended *Hibiscus strictus* for cultivation, on account of the quantity and fineness of the fibre it yielded. So also *Abroma augusta*, which he was disposed to call Perennial Indian Flax. These specimens are still in the India House collection, and fresh ones have been sent recently from Assam. The bast abounds with long, strong, and white silky fibres. The plant grows so rapidly as to yield two, three, or even four crops of cuttings annually, fit for peeling. He obtained 271 lbs. of clean fibre, which he states was three times greater than the average produce of sunn.

To prove that I do not exaggerate the importance and probable extensive employment of this class of fibres, I have only to refer to some beautifully prepared specimens of some of these fibres, which I gave to Mr. Malcolmson, of Portlaw, and which he has returned me within these few days.

Though I prefaced these observations by stating that I would not enter too much into detail or dwell upon a very large number of plants, yet, as most of those to which I have referred are the produce of the richer soils and moister climates of India, it would be desirable to find something fit to give employment to those who live near the drier and more barren and desert parts of India.

There is fortunately a plant found in great abundance in such parts of India, which requires no culture, can live without water, and abounds in fibre and a milky juice. This, moreover, is a plant with perennial roots, and of which the stems, when cut down, spring up again, and give a fresh crop of fibres. These I formerly brought to your notice, as remarkable for their strength. I now notice them as conspicuous for their fineness, flexibility, and fitness for textile purposes, as may be seen in the sample we have here, of a muslin-like handkerchief, made of the fibres of the *Mudar*, a plant which belongs to a family abounding in fine and strong fibres, and of which we have several specimens in this room. The *Mudar* itself belongs to the *genus Calotropis*, of which there are different species in Sindh, in the West Indies, and in the Madras Peninsula, but all yield this fibre.

With this, however, I will only mention a very remarkable fibre, from its strength and silkiness, which has been sent from Upper Assam, as the produce of *Paderia fœtida*.

The only fibre which remains for me to notice is one that has already been frequently brought to the notice of this Society, and that is the fibre known under the names of China-grass, Chu-Ma, Ramee, Kaloee, Rheea, and Kankhora, which is not only well known in China, but in the province of Assam in India; likewise in the Bengal districts of Rungpore and Dinagepore; in Tenasserim, Siam, Singapore, and Sumatra. Dr. Oxley, writing since my former communication, says it is indigenous all over the Malayan archipelago, grows freely at Singapore, and occurs as a secondary jungle in the greatest profusion in Java; and all that is required is the art of preparation. The Malays have always employed it for their nets and fishing-lines.

Difficulties having been experienced in inducing the natives to grow more of the Rheea fibre than they require for their own fishing-lines, the Court of Directors of the East India Company ordered a few tons to be purchased annually in each district, in order that the natives might, on extending the culture, always find a ready sale for their produce on the spot, or until the quantity should be sufficient to attract the attention of merchants.

In consequence of this order, small consignments of this Rheea fibre have been made from different districts, the quantities of which will no doubt increase yearly. These will also be sold by Messrs. Noble. There have been also sent a few other Rheea fibres, produced by other species of *Urtica* or *Bohœmeria.*

Paper Materials.

Having dwelt so long upon the subject of fibres in general, time and space will allow me to say only a few words respecting their application to paper making. This I the less regret, as having pointed out a mass of valuable material which may be and is actually employed both in India and China for conversion into paper, the subject is one rather for planters, merchants, and manufacturers, than for me to follow up. My attention was first directed to the subject in consequence of the repeated inquiries from paper-makers, and subsequently by an official application from the Board of Trade, to point out any fresh sources of material for the making of paper. India seemed to me, and still does appear, an unworked mine, from which much valuable material might be extracted, and I have no doubt that much will thence be imported, but in this, as in all other cases, we must adopt means suited to the ends we have in view. It has been objected that India is far and freights high, that fibre-made pulp will not draw well through machinery. These objections were as valid when the inquiries were made as they are now. In recommending that Indian fibres should be converted into half stuff for paper makers, I did not intend that the best fibres should be beaten up into pulp before they had been used for other purposes, because I hope that as these fibres can bear examination, and will amply repay any labour that is bestowed upon them, that they will take a higher instead of a lower place in the market. But I specially directed attention to some plants which grow in wild luxuriance, and to others which are cultivated for other purposes, and of which the fibrous part is now yearly thrown away in vast quantities. I believe that if some simple machinery were brought in aid, even of the cheap labour of India, that some of these fibres might be profitably preserved, and that the waste and tow which was obtained during their preparation might be reduced to the state of half-stuff. As an instance of the cost at which this may be done, I would beg to quote Mr. Henley, who has favoured us with a paper on this subject, published in the volume of the Society's *Journal* for 1854.

He there observes:—" It is to India we must look for extensive and cheap supplies, for it is there alone we find the necessary conditions of very low-priced and intelligent labour, with an abundance of elementary suitable materials; and that as articles of small price are particularly sensitive of charges, such as of freight, &c., it is only by large operations that an average of low charges can be accomplished."

Suitable materials being abundant, he proposes that it should be reduced to the state of half-stuff by the aid of the Dhenkee, already mentioned, as an instrument to be found in almost every house in Bengal, being used for husking rice, the preparation of tobacco, of drugs, dye-stuffs, and brick-dust.

The charges to London, including freight, insurance, exchange, dock, and in fact all commercial charges, he estimates at £7 per ton weight. It is necessary to specify the ton weight, as the ton for freight would be only 16 cwt. The cost of half-stuff of different qualities would be about £4 4s. and £7, as contracts could be made at the rate of Rs. 1 8, or 3s., to Rs., 2 8, or 5s., per maund of 82lb., deliverable at any central depôt within a radius of twenty miles. The expenses of conveyance, &c., in India, about £2 2s., and of freight to London, and other expenses, about £7; so that the lower quality might be imported here for £13 4s., and the better quality, equal to linen rags, for £16 5s.

" It would be necessary to have recourse to the usual Indian system of making cash advances to contractors ere a pound of the goods had any existence. Such, however, is the universal system of the country. The natives, it must be admitted, are wonderfully faithful on the whole in adhering to their bargains."

" The method proposes to avail itself at once of their own simple arts; it brings the question as nearly as possible to the state of domestic industry, ever the most economical in such countries; it reduces to the lowest point the charge of collecting from extensive districts the various elementary matters which might present themselves."

I believe, however, that in some parts of India, these expenses might be still further reduced, that is in places still nearer the coast, as, for instance, in Arracan, where excellent basts and ropes made from them are sold in the bazaar of Attyat, for 1r. a maund, or 3s. per cwt. Material is equally abundant in the western coast of the peninsula of India, where, however, water power might easily be applied to the Dhenkee or tilt hammer of India. This would still further reduce the expense, at the same time that the work was effectually done.

Having on a former occasion, as well as in a work on this subject, enumerated the various Indian fibres which may be and are employed for conversion into paper, I need do no more, on the present occasion, than state that specimens of most of them are here. As an instance of the ignorant objections sometimes made, one writer objects to the plantain being employed for the purpose, as he knows, from experience, that the fibre melts away, and is without substance for making into paper. Now if there is one of these fibre papers that is stronger than another, and even parchmenty in character, it is the paper made of plantain fibre. From India fresh specimens of these papers have been sent, as well as some made from fresh sources, as by Mr. Underwood, of Madras, from the fibre of mats, as well as from the fibre of the leaves of *Pandanus odoratissimus.* Captain Dalton has sent from Assam paper made from young bamboos. Mr. Botten some made of the bark of *Daphne cannabinda,* from which Nepal paper is made. We have also some bricks of the half stuff of the same, for which I am indebted to Mr. Henley. Dr. Riddell has sent paper made of the fibres of *Hibiscus esculentus,* one of the plants cultivated on account of its fruit, being used as an article of diet. The plant, he says, is of quick growth and easy of culture, and produces a very strong and serviceable paper.

In this country we had specimens of paper made from the jute of India, of different qualities, and fit for various purposes, by Mr. Hollingworth, of Maidstone. The expence of bleaching he finds to be a very small per centage above the expense of bleaching other materials. Mr. Routledge, I know, has for several years been employed in experiments on making paper from fibres.

I hope he will this evening show us some of the very successful results which he has obtained. The material he employs can, I believe, be obtained as cheaply as any thing else. I have no doubt, however, that if fibres come to be largely employed in making paper, India will participate in the commerce, as her fibres now undersell all others; and though jute is dearer than usual, it is not because smaller quantities have come in, but because it is becoming applied to a number of new textile purposes, but for some of which several of the fibres now before you are equally applicable.

Conclusion.

As we said at the commencement of these observations, it is necessary to connect the producer and the purchaser, and if we want to obtain these fibres in quantity or of good quality, we must address ourselves to local agents, who will make European wants known. For not only must the culture of a new plant succeed, but there must be a *demand on the spot* for the produce. This has been prominently brought forward by several of the Revenue Officers.

Thus, the collector of South Arcot writes:—" I do not believe that anything short of an assurance that a remunerative price will be immediately given, will induce the natives to attempt the cultivation of any novel species of produce." From Tanjore, the collector writes, that "the cultivators have no desire for speculation, and no faith in mere assurances that articles fitted for the European trade will meet with a ready sale at Madras." So in Canara the same officer writes:—In this district, " the Ryots want very little encouragement to cultivate any article beyond a certainty of remuneration. But it is of no use to tell them that any article is of value in a distant market. This is nothing to them. The only question is, if they produce it, will any one give them money for it on the spot, for if any one will, they will produce it immediately." He adds, that he considers the Indian hemp, that which we have already seen, is of such good quality from Canara as to be the most promising article. These officers adduce the fish-oil of the Malabar coast as having become lately an article of export from the Malabar coast. So in South Arcot, the ground nut has come to be largely produced, and its oil exported, in consequence of a remunerative price having been offered by a merchant at Cuddalore. In Rajahmundry and Ganjam, sugar, they mention, as being cultivated in this mode as indigo is in the Cuddapah district.

So Mr. Henley, as we have just seen, recommends dealing with the cultivators by means of native agents, who make advances, and make contracts, and are responsible for the delivery of produce.

The natives of India ought, moreover, to be assisted with machinery suitable for the separation of fibres, and not of a very expensive character, and which might be moved either by hand or bullock power. I may adduce the small cotton gin, the construction of which was superintended by the Commercial Association of Manchester. The natives of India, who would only buy these small machines at first, have since bought about 300 of them, many of them with 10, 20, and 25 saws.

Having thus gone, as briefly as possible, over the extensive field spread before us, I have only to recapitulate the points which seem most worthy of notice. First, that the west coast of the Bay of Bengal, as well as the Peninsula of India, abounds in basts and barks, which are cheap in price, and might be brought as dunnage, if not thought worthy of being converted into fibres or half-stuff. Among cordage materials, besides the brown hemp of Bombay, there are some excellent varieties on the Malabar coast, and in Canara, as well as in other parts of India. The chief point would seem to be to encourage the natives to collect and prepare the fibres as carefully as possible, which there is every probability of their doing, if encouraged by adequate remuneration from the local buyers. The Plantain and other white fibres, are well worthy of forming cordage for ordinary purposes, until they are produced in sufficiently large quantities to make use of them for other purposes. We have also had before us the true hemp, which, though imported from the distant Himalayas, is able to compete in price, as it does in strength, with the hemp of Russia.

Among textile substances, we have seen that there is considerable probability of the successful culture of flax in the Punjab, and perhaps in some other district. But it has appeared very desirable that we should at once make use of some of the indigenous fibres of India which seem well adapted for the purpose, as we have seen the marvellous effects produced by careful preparation on some of these fibres. Those from the west coast seem at once available, while the beautifully prepared and silken fibres of the Hibiscus seem much too valuable to be any longer neglected, and the plants which produce them unite the good qualities of rapid growth, easy cultivation and ready separation of their fibres.

Among the fibres which appear most desirable, from the excellence of their qualities, is that of the Mudar plant, or its nearly-allied species, which abound in desert places, and grow without culture or water, may be yearly cut down, and yearly produces fresh stems. In the qualities of strength and fineness, this seems to come nearest to the China grass, of which, as the Rheea of Assam, we have noticed the imports by several ships, which will probably assist in establishing it as a regular article of import from India, as well as from China.

Most, if not all of those fibres, are fitted for making into paper stuff. Though most of them, from being applicable for cordage or textile purposes, are able to command higher prices than the paper-maker can give, yet some may be brought for such prices as he can afford. Many of them, I feel no doubt, will occupy high places among the imports, as well as among the prices of fibrous materials, and may rival in quantity the jute, which was at one time thought worthless, but which cannot be had in sufficient quantities for our manufactures.

In conclusion, I trust I may refer to an observation I formerly made, and that was, the confident hope that the Collections of Raw Products which were being formed would have considerable effect in diffusing correct information on all such subjects; and I said, that as in the City time was counted in minutes, I would have one in the very heart of the City. I may congratulate the Society on the speedy establishment of a Museum at the India House, which will contain, for permanent examination and constant reference, an ample collection of the Raw Products and Manufactured Articles of the vast Indian empire.

DISCUSSION.

Mr. Routledge said that he had great pleasure in complying with the request of Dr. Royle, to show the paper and half stuff he was now manufacturing from a raw fibrous material. These specimens of paper were by no means perfect, and only served to illustrate what may be done with a raw material. At the mills with which he was connected, they were now putting down additional plant, and in the course of a few months they would be in a position to supply half stuff or paper pulp to the trade. The scarcity of paper-making material was a question which had notoriously, for some time past, attracted the attention not only of paper-makers but of all commercial circles, as it was generally admitted that, although the ratio of increase in the manufacture of paper has fully kept pace with that of our two other great staples, iron and cotton, it differs from them in the daily increasing deficiency of supply in its manufacture. The abolition of postal restrictions and the spread of cheap serial publications, had, during the past few years especially, given great impetus to the production of paper. In the 5 years from 1830 to 1834, the annual turn out of paper was 31,423 tons; but in a similar period, from 1849 to 1853, it was 67,515 tons; and in the 2 years 1853 and 1854, it was 79,291 and 79,418 tons. Notwithstanding this increase, he (Mr. Routledge) believed he was correct in stating that the consumption of paper in England, taken according to the population, is considerably less than in other counries; in America, for instance, the consumption is 13lbs. per head per annum; in France, 9lbs.; in Belgium and Holland, 8lbs.; but in England, only 6¾lbs. to 7lbs. The published excise returns hardly gave a fair data for calculation. The price of raw material in France, Belgium and Holland, was much below that in England, as much as from 10 to 15 per cent., and the material was also much better, as in those countries more flax is employed for body linen and clothing than in this country, where cotton is more generally used; in America the price of material is much higher than in this country, the Americans being large buyers of raw material in this market, and their price being consequently enhanced by the cost of carriage. Within the last four years, also, the Austrians had prohibited the exportation of rags; and in France, Holland, and Belgium, the exportation of raw material for paper-making is also prohibited. Three or four years back, the rise of the price of material in this market was as much as 20 to 30 per cent.; this was, however, checked by the late war, and the high value of money since has checked production, but this year the demand is again increasing. He might add, also, that the quality of rag material is much deteriorated, partly from the decreased use of flax for fabrics, such as shirting and women's garments, and partly from the increased demand compelling the paper-maker to admit of an inferior selection of his sample of rags. In his own mill, for instance, where they purchased a low quality of rags, it was no uncommon circumstance for him to see oil-cloth, tarpauling, &c., &c., and there was always a large per centage of woollen rags in the lower assortments, which are thrown out—the better descriptions for shoddy, to mix with the lower qualities of woollen cloths, and for the paper-stainery flock, and the commoner sorts for manure. He believed that one of the first duties which would be remitted so soon as our finances permitted, would be that on paper, and immediately thereafter an immense increase of production would result. Looking to the improbability of any very considerable addition to the supply of raw material through the present channels, and as the high value of land and labour in England act as a practical prohibition to any production here, it was obvious that we must look to foreign countries, and our colonies especially, to meet the necessities of the case. Dr. Royle had, therefore, done the community at large, and our colonies especially, infinite service in directing attention to these valuable and reliable sources of supply, and he (Mr. Routledge) hoped that one main obstacle in the way had now been successfully overcome, which was the treatment of a class of textile plants, which exist in immense abundance throughout India and our colonial possessions generally. The chief staple of food of the negro and labouring population in our West Indian colonies is the fruit of the plaintain, of which a specimen had been kindly furnished by Sir Wm. Hooker, from Kew. When the stem of this plant has fruited, if not cut down it dies away, but generally immediately the fruit is obtained the stem is cut down, and considerable expense incurred in removing it to make way for others. This stem, as would presently be demonstrated, abounds in a fibre of the most valuable description, fitted for all textile purposes; and the tow refuse, or that damaged by imperfect preparation or the voyage to this country, is a most valuable adjunct for the paper-maker, either to use *per se*, or to mix with his present material. At a moderate calculation half a million tons of this valuable fibre were annually wasted, which now might be rendered available by the agency of the extremely simple machine before the meeting, the operation of which would be shown by Mr. Warren, the engineer and manufacturer. The machine was the invention of Mr. Francis Burke, a colonist of Montserrat, and he (Mr. Routledge) considered, from its efficient action, that this problem was now solved. In the year 1838 a patent was taken out by Mr. John Small, for Improvements in Thread or Yarn and Paper from Plantain Fibre, and numerous other patents had subsequently been taken out with the same end in view—some by machinery, others by chemical means. The latter might briefly be dismissed with the remark, that any chemical treatment sufficiently powerful to dissolve or reduce the pulpy matter to a state fit to be separated from the fibre, would seriously injure the latter, even if it could be rendered effectual, which was very doubtful. With reference to the machines, none hitherto had answered the purpose. All the engineers who had gone into the question had endeavoured to imitate the action of the comb or heckle, combined with brushes and scrapers, and these, besides their liability to breakage, required skilful manipulation, which was not to be relied upon in the colonies. The exception to this rule was a machine with which he was connected in the year 1852, which was exhibited at Messrs. Pontifex's. This machine, however, when sent abroad and set to work, was found not to answer—it was extremely costly, very cumbersome (weighing some tons), and the working parts liable to derangement; whereas that of Mr. Burke was simplicity itself, and the fibre was produced in a perfectly clean state, fit for market; as a proof of which he might add that he had been offered, by an eminent fibre broker, £33 per ton for 100 tons or more; and when once introduced in sufficient quantity to attract the attention of consumers, there would be little doubt that the price would advance. Dr. Royle, than whom they could have no better authority, had informed them that the plantain and banana were the cultivated varieties of the *Musa textilis* of the Philippines, from whence they procured the Manilla hemp, which was so much esteemed in this and the American market for ropes and cordage; indeed, the Americans, if they could procure Manilla hemp at anything like a reasonable price, employed it in preference to all other fibre for these purposes. Two years back the finest samples of Manilla hemp sold for £115 per ton. This, perhaps, was an exceptional price, but he was told, on excellent authority that a very high price would be obtained for plantain fibre of good quality. The machine in question would equally treat all the different varieties of endogenous plants. He would not pretend, in this brief notice, to recapitulate the different varieties of plants, as they would be found enumerated in Dr. Royle's work on Fibrous Plants, but would limit himself to the aloe, or *Agave Americana*, the different varieties of yucca, the pineapple, *Phormium tenax*, &c., on which it had been tried, and its action found perfect. All these plants abounded in our colonies, and could be produced at merely a nominal cost to a practically unlimited extent. The machine now exhibited would produce 30 lbs. of clean fibre per diem, and required the attention of a man or boy for feeding, but Mr. Burke had invented a machine which might almost be termed automaton, the working parts, that is the revolving toothed drum and elastic bed were the same, but in front of these were fitted feeding rollers, into which an attendant had only to insert the lanyard or strip of stem, and the same was delivered at the other side with all the pulpy matter or parenchyma detached therefrom, requiring to be thrown into water to dilute the gummy or mucilaginous matter, when it is dried and baled for market. The stem of the plantain, or rather the annular rings, consisted of two descriptions of fibre, the upper, long and strong, the under more soft and silky. In the smaller machine, this was entirely removed by the action of the beater when drawn back, and would require to be subsequently separated from the pulp, when it would sell to the paper-maker; but in the larger machine this lower portion of fibre was retained, when it might be separated by drawing through a coarse heckle or comb. The larger machine would produce 2 cwt. of fibre per diem. Thirty small machines might be driven by a steam-engine of 10 horse-power, and 10 of the larger ones by one of the same power. The samples of paper before the meeting would show the adaptability of the plantain fibre for paper-making. The coarse paper had a portion of New Zealand flax intermixed—of the other two, one was entirely from plantain fibre, the other with an admixture of rag in the proportion of one-third. To resume the paper-making question, in which he (Mr. Routledge) was more immediately concerned, it must be borne in mind that the paper-maker now only used the refuse fibrous products, unfitted for any other manufacturing purposes, such as rags, worn-out canvass and rope, sacking and bagging, tailors' cuttings and refuse, and what might be termed the offal of the spinners and manufactures, the sweepings, in fact, of their mills—the chief of which were cotton, hemp, and flax waste. Paper had also been made from wood, the bark of trees, hop-bine, bean-stalks, sunflower, hay, straw, couch-grass, or twitch. Two or three mills were now using straw pretty extensively, and a mill was now being erected to manufacture paper from twitch, which, however, was no novelty, for in the year 1832, he believed, when the Royal Agricultural Meeting was held at Oxford, Lord Alford presiding, the proceedings were printed upon paper made from twitch or squitch at the mill now in his (Mr. Routledge's) occupation. The paper-maker, in fact, refuses no fibrous refuse (excepting that of wool and silk), being governed in the price he gives by quality, or in other words, adaptability, to his purpose, and the loss incurred in manufacturing the same into paper. It was obvious, from the above brief description of the paper trade, that there is a wide field open for the introduction of any material which will meet the necessities of the case, but to ensure a successful commercial result, two important questions must be determined—first, that the material shall be convertible into paper, or paper pulp, of good quality, at a comparatively trifling expense, and with uniform success; and secondly, that there shall be a certainty of a constant and unvariable supply of this material at a very low price, not liable to fluctuation. He believed these requirements were satisfied in a great measure by the half stuff that he would shortly be in a position to supply; but the plantain, aloe, and similar fibres, were superior in quality, although their cost would be greater. There was, however, a wide field open, and he believed the paper trade would absorb, without difficulty, many thousand tons yearly. The effect would be to reduce the cost of rag material, or at least to induce a better assortment thereof, which would produce the same effect. It now only remained to consider the objections which could be urged against the use of any new fibrous material for paper-making. They are the great difficulty always experienced in inducing manufacturers to adopt new processes, and alter existing appliances at their mills. This was not to be wondered at, considering the great outlay and risk involved in altering machinery and making experiments, which obviously must also materially interfere with the current operations of their business. Moreover, the greater number of paper-mills in this kingdom are worked in a great measure by water power, and being remote from mineral districts, fuel is expensive, rendering steam power costly, and coal for chemical purposes a consideration. And it must be borne in mind that a raw material requires a totally different system of chemical treatment by the paper dealer, to that usually adopted by him for the present rag material, which has, previous to coming into his possession, undergone the process of reduction to a fibrous state and bleaching, before it could be worked into a fabric and printed, and subsequently, while in use, has been to a certain extent further disintegrated by wear and the usual manipulations of the wash-tub. From these various causes there would no doubt be great difficulty in introducing any new raw material generally to the trade, unless it is assimilated in character and facility of treatment to the materials now employed. These remarks would in all probability be made by a maker to whom it was sought to introduce any new material in a raw state, and due consideration must therefore be given to objections (which must not be called prejudices) for which there are good grounds. In Scotland, flax and hemp-waste were now extensively used in paper-making, and the chemical treatment of a raw fibre better understood. These objections did not apply with the same force to a prepared half-stuff, but, on the contrary, there was every inducement for a maker to employ a material which would afford him the following advantages, viz., quality, cheapness, and facility of increasing his output with a positive diminution of outlay. He might add that he had taken out a patent for the treatment and preparation of raw fibres into half-stuff, which applied to the plantain and similar fibres. The prepared half-stuff could be supplied pure and clean, and bleached to any desired standard, and might then be used *per se*, or mixed in any desired proportion with the present materials employed.

In reply to the Chairman,

Mr. Routledge said, he was not sure cocoa fibre could be bleached, but the plantain and many others could be bleached as white as the driven snow. The only descriptions, perhaps, which would not stand it were the jutes. All the hemps would. The machine was adapted for the agave genus as well as for the plantains.

Mr. Warren (presenting a portion of plantain stem, which had been just previously operated upon by the machine) said, it would be observed that the fibre had not been in the least degree broken or injured by the operation of the machine, but was presented entire throughout the length of the piece. With regard to the larger description of machine mentioned, it had been thought desirable to construct one capable of producing greater quantities of fibre. The machine now before the meeting required the attendance of one person, but he saw no reason why (as had been the case with cotton-spinning) the attendance upon each machine might not, hereafter, be greatly reduced. He believed that in the course of a very short time a boy would gain sufficient dexerity from practice to be able to keep two machines going, as only one hand was required in the working of each. Mr. Warren then explained the advantages of the larger machine, describing some of its parts and its principle of action. One peculiar feature of this machine was, that it retained the silky part of the fibre, which in the operation of the smaller one was lost to a great extent. The action of the small machine Mr. Warren described as being rather that of a beater than a squeezer, but the fine fibre, which was of double the value of the other portion, was mixed with the pulpy matter thrown off. In the large machine this was preserved.

Mr. Noble said he was willing to take the fibre in the state in which it was shown to him at £33 per ton in any quantity. He considered the fibre from the small machine as best suited for general purposes, such as rope making, &c.

Mr. Warren, having passed through the machine a piece of the agave, showed that the fibre could be perfectly separated, but that from the variable lengths of the fibre, being shorter at the sides and longer in the middle, in the drawing-back process the short fibres were apt to be lost, passing through with the pulp.

Mr. Ridgway said, at the Great Exhibition of 1851, there were specimens of fibre of the plantain from Demerara, which was stated to be worth about £45 per ton. Mr. Ridgway called attention to a specimen on the table, which he said was wholly prepared in Demerara. Any quantity of that fibre could be produced if they could only procure the labour necessary. Some time ago an advertisement appeared, offering a large premium for the discovery and application of a material as a substitute for rags in the manufacture of paper. Baron de Thierry sent to the Paris Exhibition paper made from fibrous materials from New Zealand. Mr. Ridgway called attention to the lace bark from Jamaica.

Mr. Routledge referred to the *Demerara Gazette*, of June 1st, 1852, in which an advertisement appeared, to the effect that the Guiana Textile Fibre Association, together with most of the eminent residents in the colony, had made a subscription, which was forwarded to him, for the purpose of purchasing a machine at that time, made by Mr. Pontifex; but as that machine did not turn out so well as was expected, nothing was done. He had also a communication from Demerara, which fully confirmed what had been stated by Mr. Ridgway, namely, that plenty of planters were ready to take the matter up, if they could get suitable machinery for the purpose. He had also been furnished with calculations of the cost of production, of carriage to the mill, and all the various particulars. He believed there was a gentleman from Demerara in the room, who could confirm all that had been stated with regard to this question by the planters in that island—if they could only get suitable machinery and insure a regular market for the commodity.

The following is the estimate referred to by Mr. Routledge:—

Assuming Mr. V. der Gon Netscher's calculation of 4,500 stems every two years as a basis, we have 2,250 stems per acre per annum; 74 acres therefore would be required to yield 300 tons of fibre per annum; 560 stems, 80lbs. gross per stem = 44,800lbs., or 20 tons, which at 5 per cent. gives 1 ton of fibre; the 2-cylinder machine will turn out 2 cwt. of fibre per diem.

First Outlay.

10 machines at £100 each	£1000	0	0
12 H. P. high pressure steam-engines	250	0	0
Buildings, sheds, bricks, &c.	500	0	0
Carriage of machinery, and fixing tanks, pipes, connections, &c.	300	0	0
Say for unforeseen expenses	450	0	0
Maximum	£2500	0	0

Analysis of expense per ton fibre.

10 per cent. interest on £2,500	£250	0	0
Rent, management, expenses, &c.	350	0	0
	£600	0	0

Daily proportion of above	£2	0	0
Engineer per diem	0	7	0
Coals for engine, 15 cwt.	0	15	0
3 men attending machines 3s. per diem	0	9	0
6 boys ditto 1s. 6d. ,,	0	9	0
560 stems, carriage to mill	1	10	0
Proportion of cost of cultivation	1	17	6
Packing and expenses royalty	1	2	6
Freight to England £2 0 0 Other expenses 1 10 0	3	10	0
Total cost per ton	£12	0	0

Mr. Ridgway remarked, that he was agent to an Association in Demerara, which was ready to produce any amount of fibre at a very small cost—next to nothing—if sufficient labour could be obtained. That was the difficulty. The merchants at present confined their attention to sugar and rum. Formerly the colony grew large quantities of cotton, and could do so now, sufficient to supply all the markets or Europe.

Mr. Sharp said, it had not been his intention, when attending the meeting, to have been otherwise than a mere listener. In that character he had listened with attention and pleasure to the able and lucid statements of Dr. Royle. But matter had occurred in the course of the discussion to induce him to say a few words. The lecture had especial reference to East Indian fibres, but the observations were equally applicable to West Indian fibres; indeed, to tropical fibres generally. He (Mr. Sharp) represented a company recently formed, under the title of the Colonial Fibre Company, incorporated by royal charter. The operations of the company were limited, by charter, to the colonies of Jamaica and British Guiana, which alone are capable of producing from 500,000 to 700,000 bales per annum of plantain, besides large quantities of other fibrous plants. Some experiments had been made by a machine in the room. He could offer no opinion upon the action of that machine. He wished the parties interested in it every success. There was ample room for them, and himself, and many others. At the suggestion of the secretary he had much pleasure in placing upon the table a few specimens of various plants as they grew. They consisted of transverse and longitudinal sections of the plantain, the *Agave Americana*, or large American aloe, the *Aloe angustifolia*, the *Aloe variegata*, the *Bromelia penguin*, or wild pine, and one known under the name of silkgrass. The court of directors of this (Mr. Sharp's) company were anxious to satisfy themselves of the practical working of the machinery to be employed in the colonies, and, therefore, instructions were sent out to the correspondents of the company in the West Indies, to forward by every mail-steamer a number of the different plants for experiment. The plantain consisted, as would be seen, of a central portion, the peduncle or fruit stem; but as that stem could not, of itself, sustain the heavy weight of fruit, the support was afforded by means of the concentric rings which surround the central portion, and are merely the petioles or footstalks of the leaves. If the rings were examined, it would be found that the entire outer portion of each constitutes a mass of fibre, the inner portion consisting of mucilaginous matter, which would be removed in obtaining the fibre. The fruit stem, it would be seen, contained a very fine and beautiful fibre, resembling cotton, and capable of being worked with it. It must be observed, that the same machinery which prepared the plantain fibre would not work effectively many of the other plants. For instance, the penguin had a cuticle of so hard and siliceous a character as to require a different mode of treatment; and so with several of the others, rendering modifications of the machinery necessary. Mr. Sharp exhibited specimens of the fibres as prepared, consisting entirely of the products of the plantain. No. 1 was the fibre as obtained from the plant; Nos. 2 and 3 were preparations which assimilated it, in external character, to hemp; Nos. 4 to 7 were various modifications, developing the finer filaments of which the original fibre was composed, giving it somewhat the appearance of flax. The other specimens were the cotton-like material obtained from the fruit stem, and the rougher looking article was derived from the mucilaginous matter removed in separating the fibre. He also showed a piece of rope made from it. He submitted to the meeting another series of specimens, consisting of the produce of many different plants, some of them of great beauty and value, together with some dyed. Some of these specimens were of Indian origin, and he had arranged for an exchange of seeds of such fibrous plants as were indigenous to the east, and not grown in the west, and *vice versa*. He thus hoped to give to each country the advantage of an extended growth. In this arrangement he had been materially aided by Dr. Royle's valuable work on Indian fibres. It might be asked, why he had not exhibited here machinery, or some drawings illustrating it. The answer was short. Those machines were made the subject of patents, and prudential reasons forbade any disclosure of their construction at present. They had been devised, with great care and attention, under the direction of Mr. Benjamin Fothergill and Mr. Charles Beyer, of Manchester. Each machine was capable of producing, in a day of ten hours, from 400lbs. to 500lbs. of fibre, with an expenditure of half a horse-power. Mr. Sharp finally submitted some fibre, which he stated had all the character of the finest flax, and that some of the most experienced flax-spinners of this country had declared it superior to Russian flax, approaching Belgian in quality; and that it was capable of being spun and manufactured into all the fabrics in which foreign flax was employed.

Mr. Trent said he had expended considerable time and money in bringing machinery to bear upon the manufacture of fibrous plants, and he claimed to be the first to obtain the long fibre from the cocoa-nut husk. He bore testimony to the beautiful manner in which the fibres of the material operated upon that evening had been separated by the machine before them; and, between Mr. Sharp and Mr. Burke, he had no doubt that in a little time they would become quite independent of Russia and all other foreign countries for the supply of fibrous materials. Dr. Royle, Dr. Hooker, and Mr. Henley had done good service in introducing these fibres to their attention. He (Mr. Trent) was now in hopes of something practical being carried out. On visiting Russia, some three or four years ago, he was satisfied, from what he saw there, that in a few years they would have the whole of the export trade in ropes to themselves. He visited two of the principal rope works in that country, and from the extent of plant, and the amount of work going on, he was satisfied that they were making as much rope in those two factories as was made in all London, the whole of which was for exportation. They were using English machinery, which had been in operation there from 20 to 25 years. He believed the Russian manufacture brought better prices in the colonies than the English. As a rope-maker himself, he was ashamed to see some of the descriptions of rope made for exportation. It was of a character to damage their reputation entirely as rope-makers. He had seen some rope made with mere waste, spun into fine yarn. A person sometimes had a three-inch rope that would not bear the strain of a properly-made two-inch rope. He lately attended some experiments with ropes at one of the Royal Dockyards, to test some Irish flax unsteeped against some Russian hemp. They tried some three-inch rope of Irish flax and some three-inch rope of Russian hemp. The Irish flax rope broke at a strain of three tons; the Russian hemp at three tons three cwt. Some rope made from Italian hemp was afterwards tried, and it bore a strain of four and-a-half tons. With regard to the Rheea fibre, he was satisfied that it was adapted to every purpose of rope-making as well as to the finest fabrics. A friend of his in Leeds had told him, that if he could get a sufficient supply of that fibre he should no longer use flax, but that it was not worth while to adapt machinery to the small quantity that was at present attainable.

Mr. Warren said, that the machine had been found applicable to the cleaning of any description of fibre that had yet been presented to it, even to the hard and dry American aloe, shown that evening.

The Chairman said, it had been his intention to offer some observations on the subject before them, but time prevented. He would, however, remark that Dr. Royle had proved that whereas, within the memory of men now living, England could only boast of two fibres—or little more—namely, hemp and flax, others had now been introduced to their notice, probably 200, from which they might take their choice, from the longest and coarsest, fit for the strongest cable, to that suited for the finest piece of muslin, to cover the most delicate form. The plantain, the pine-apple, the Hibiscus, the Crotalaria, hemp, and many others, which are either cultivated or grow wild all over India, together with the celebrated Rheea, nettles, and Asclepias, which produce the most delicate fibres for muslins, are equally available for manufacturers who desire to procure them through agencies. In fact, they had an unbounded choice, if they only went after them. It was not to be expected that those within whose sphere these products were available should be acquainted with the mercantile requirements of other countries. The materials themselves, in the various forms in which they were now presented, having been laid before them, and their properties explained, it was for the manufacturers themselves to decide which was the best adapted for their purposes, and to take the means to procure a supply of that which they wanted. The whole of the materials and fabrics now exhibited would be arranged in a museum at the India House, in the course of a short time, for the public benefit, where any manufacturer could form his opinion upon the peculiar desirableness of any particular fibre for any particular fabric, and adapted to any particular machine. Then, through agents employed in India, he could, no doubt, organise a system of supply suited to his purposes. The plantain grew wild on the western Ghauts, from Cape Comorin to 25 degrees of north latitude, millions of stems opening up every monsoon, only to perish unappropriated. In all tropical regions they would find, generally, fibres of a similar character. There had been two great fibres mentioned that night as substitutes for hemp and flax, and they were of the greatest importance—namely, the *Hibiscus cannabinus*, and the *Crotalaria juncea*. He thought that Dr. Royle had proved that he was eminently entitled to the hearty thanks of the Society for the large amount of valuable information he had afforded upon a subject most important to our manufacturers, if they chose to profit by it. He need scarcely invite them to pass a vote of thanks to that gentleman by acclamation.

A vote of thanks was passed to Dr. Royle.

In addition to a very large display of fibres exhibited by Dr. Royle, specimens were shown by Messrs. Sharp, Pye, and Dickson. A machine for preparing the fibre from the plantain and other tropical plants was shown by Mr. Routledge, and worked in the room. Specimens of paper and pulp from some of the fibres exhibited were shown by Mr. Routledge. The Secretary announced that the specimens of fibres, &c., would remain till Saturday, in order that the members and their friends might have an opportunity of examining them.

The Secretary further announced, that on Wednesday the 3rd of December, a paper, by Mr. Christopher Binks would be read, "On some New Methods of Treating Linseed Oil and other Oils, for Improving their Drying Properties in their Application to Paints and Varnishes." On this evening, Henry Blundell, Esq., will preside.

Home Correspondence.

PAPER-MAKING MATERIALS.

Sir,—I have read with deep interest the article in your *Journal* of the 10th inst., on the "Paper Material" question, by Mr. William Stones, and I forward this communication to you in the hope that one or two interesting points connected with this question, and only briefly referred to in his article, will be found treated of with the greater detail which their importance appears to me to demand.

A manufacture which is instrumental in converting utterly valueless materials into an article not merely identified with all our commercial operations, but an absolute necessity to civilized existence, is entitled to sustain, not only a high rank in the scale of the manufacturing industry of the country, but to be emancipated from those galling restrictions upon its growth and prosperity, in the shape of a fiscal charge of some 30 or 40 per cent. upon the aggregate value of the manufactured article; the oppressive and unjust character of this impost will become at once apparent by considering that on the lowest article of comparative value, (paper used, for instance, in packing sugar) the duty alone is 80 to 90 per cent., and upon the more valuable papers, used for correspondence and the cultivation of the fine arts, the duty is 10 to 15 per cent. It can be clearly shown to impose a very manifest limitation upon the educational resources of the country, as affecting the humbler classes in the shape of cheap newspapers, periodicals, and school books, as also upon those branches of industry of which paper forms, as it were, the raw material. I need scarcely mention paper-staining, a manufacture becoming intimately identified with the domestic comfort and elevation of the working classes, and, by the cultivation of an improving taste, tending to general social improvement.

Soliciting your indulgence for this digression, I may first remark that, the scarcity of material in 1854, inducing the somewhat *equivocal* offer of a reward of £1000 by the *Times* for the discovery of any new material suitable for paper, was in fact artificial. A little inquiry would have sufficed to show, that in the last 25 years, more especially, the supply of raw material has fully kept pace with the demand: one fact will suffice to confirm this statement viz., The paper charged with excise duty in 1836, when the rate was reduced from 3d. to 1½d. per pound, was under 50,000 tons; the present production is 86,000 tons, demonstrating that the increase of population, combined with other incidental sources of supply, have prevented any very serious inconvenience from the want of raw material; and testing the argument pecuniarily (allowing for the artificial prices of commodities immediately succeeding the continental war), it may be mentioned that the rags which in 1818 were commanding £65 per ton, were at the time of the "*Times* panic" selling at £30. I refer to the finest quality of rags, which at all times bears a corresponding value to lower qualities. The application of chemical science, aided by mechanical invention, has contributed to the application of inferior and more abundant materials to the useful purposes of manufacturing printing and news papers, which would otherwise have been applied to the commonest kinds;nor can we fully estimate the beneficial influence produced upon the paper manufacture by the introduction of lucifer matches in substitution for that old-fashioned household necessity, the tinder-box, to which Mr. Stones only briefly alluded. It may be fairly assumed that the supply of rags from private houses has in consequence been increased 40 to 50 per cent. Let us now look at our supply of material under a fair estimate of production, taking the average production from the population arising from the consumption of all fabrics composed of cotton or linen material at 4lbs. per head, we obtain from

28,000,000 of people, say—	56,000 tons.
Imported	10,000 ,,
From the mercantile marine and naval services of the country, rope and canvas ...	20,000 ,,
Cotton waste, 15 per cent. upon a consumption of 38,000 bales per week...............	50,000 ,,
Linen waste	20,000 ,,
	156,000 ,,

To produce 86,000 tons of paper, we have 156,000 tons of raw material, and a further supply of material not enumerated, arising from the consumption of cord of various kinds in packing goods. Millers and other sacks may be added, and my estimate, taken rather below than above the actual fact, gives for the present a suitable supply, the adequacy of which to any present demand cannot be doubted; what may be the future of the paper trade consequent upon the repeal of the duty and the diffusion of education, can only be gathered from a reference to the United States, where national education practically and universally prevails, and where the manufacture of paper (*without any Excise Duty*) is double that of England; and this tends to show that the supply of rags progresses with the growth of population and the development of the paper manufacture. It is true that in America a considerable quantity of the common kinds of paper is manufactured from straw and other vegetable fibres, and that the importation of rags from Hamburgh, but more particularly the Mediterranean, and at times from Great Britain, may reach in value 3 to £400,000 per annum, yet the enormous quantity of printing paper used, and manufactured there from linen and cotton material, demonstrates my proposition of the supply of rags derivable from the population of a country being commensurate with the manufacturing requirements. In 1841 the very large supply of cotton waste, previously used only for very common papers, and for which straw is now the substitute, was applied under my assistance, and is now extensively used for printing papers, as in Europe. Nor must we overlook the circumstance that the rapid growth of the paper manufacture in America has been cotemporaneous with our own, and we see that the investment of capital in this branch of industry has never been retarded by any apprehension of the want of material.

If we look again to France, with a manufacture of 70,000 tons, a restriction existing upon the exportation of rags, and a very rapid extension of the manufacture during the last 25 years, yet the population has supplied the necessary wants of the trade, and prices range much lower than in England.

You will perceive that I concur mainly in the very correct view of Mr. Stones on this subject, and we can now enter more fully upon the circumstances which will justify the introduction of any new material in competition with rags, bearing in mind that the only circumstance that can dispense with the use of rags, will be that a possible reduction in price arising from the introduction of a cheap and abundant material may reduce the price to a minimum which will not compensate for the labour of collecting them. Or, again, that a corresponding costly material may be introduced that will yield a superior texture of paper. These are the two conditions that admit the application of a new material, and the main problem to be solved is the minimum price at which the collection of rags will cease; this I estimate at 1¼d. per pound, taking the average value of all rags collectively, because this price to a manufacturer of paper includes the labour of collecting and the profits of two or three trades; and in the homes of the middle and higher classes, where the rags are the perquisite of the domestics, a very low price, say a half-penny per pound, would not induce the preservation of rags. Again, as a safe proposition, I maintain that the importation of a vegetable production, expressly grown or cultivated for this particular purpose from a foreign country, will not compete with rags. The only material or vegetable substance that will maintain a becoming pretension to adoption must be of domestic growth, and produced incidentally to the growth of a more valuable commodity—as grain, for instance—the straw from which has in most countries occupied the attention of many scientific experimentalists as being the cheapest and the most abundant of any known fibrous vegetable substance; of its abundance, it may be safely asserted, that if the whole of the paper now manufactured were made from straw, it would not absorb two per cent. of the aggregate growth of the United Kingdom. The manipulations that have been during the last ten years advancing, and which are still advancing with a view to demonstrate practically the economy of straw as a raw material, have established a remarkable saving of power to the extent of 70 per cent., as well as the presence of a sort of natural size in straw which, aided by a very economical application of cheap vegetable size, dispenses wholly with the expensive operation of animal size as applied to writing and news papers; but as a sufficiently high degree of quality has not yet been obtained to enable straw paper to assume even a mediocre rank in the scale of prices, the economy of the manufacture has not yet been fully established, but the elaboration of the manufacture, now rapidly progressing, affords abundant promise of such results being effected (notwithstanding the proverbial discouragement, which the paper-dealing trade has manifested towards new improvements), as will render it an instrument for securing that prime necessity of social life, more especially for purposes of education as well as for the extension of the now ridiculously limited export trade of Great Britain, viz., cheap paper the natural result of cheap material.

I am, &c.,
N. N.

October 27, 1856.

BESSEMER IRON.

Sir,—Mr. Gladstone is in error when he asserts that I endeavour to impute improper motives to his friends, the ironmasters. I merely stated the fact, that those gentlemen, in common with many others, from the very natural impulse of self-interest, are extremely averse to change; a circumstance that can excite no surprise, when we reflect that the introduction of more economical processes and operations can be productive of no benefit whatever, in a pecuniary point of view, to themselves. In the present instance, it is calculated that three millions would be saved annually to the nation, if the Bessemer process were to turn out successful; but these millions would not pass into the pockets of the ironmasters, as Mr. Gladstone would appear to insinuate; their profits would remain much the same as they are now; and as the ironmasters are enabled to amass fortunes reckoned by hundreds of thousands, they, at least, cannot have much to complain of.

Those gentlemen are naturally averse to any change which implies trouble or expense, merely for the benefit of the consumer, and will only adopt improvements upon compulsion, by one of their number taking up a new process and underselling the others, or by the ruin of the inventor, as in the case of Henry Cort.

I do not constitute myself the champion of Bessemer's process. It must stand or fall by its own merits alone; but the projector of an improvement is not to be hunted down with impunity in these days of free discussion. There have been projectors in all times, and they have always been made subjects of ridicule; but without the assistance of those gentlemen we should still be clothed with fig-leaves, or in sheepskins, at most. In regard to the present case, I again repeat, without fear of contradiction, that Mr. Bessemer has produced ingots of malleable iron (not forged iron) without the expenditure of either labour or fuel. Let the ironmasters, if they have any wish to prevent animadversion upon their motives, repeat the new process at their own works, and thoroughly test its worth.

Mr. Gladstone speaks of the "forging process," as if Mr. Bessemer's invention was intended to supersede the necessity of that operation; while he, Mr. Gladstone, and every other man who knows anything of iron, is perfectly aware that it is impossible to produce forged iron by any other means than the rolls or the hammer.

I have already disposed of Mr. Hall's munificent offer of trial by wager, through another channel; but I cannot refrain from expressing my surprise, that two gentlemen of such high standing should have attended a lecture upon the Bessemer process at the Royal Polytechnic Institution, where the illustrations must of necessity be on a very small scale, when they could as readily have seen the whole operation performed by the inventor himself; or when Mr. Hall, whose make at the Bloomfield iron works is a thousand tons per week, could have tested the new process upon the largest scale, with little or no inconvenience to the daily routine of such a colossal establishment.

I am, &c.,
HENRY W. REVELEY.

Poole, Dorset, Nov. 23.

BROWN LIME.

Sir,—In reply to Mr. Reveley's letter on "brown lime," I beg to remark that this substance is well known in this country, and is to be found in several places in Wales. It is constantly used as a hydraulic cement by engineers, who are well acquainted with its properties, and also with some of the sources of supply. I believe that used in the Liverpool and Birkenhead Dock Works is obtained in Flintshire. I myself sold a considerable quantity of it to Messrs. Mackenzie, Brassey, and Co., the well-known railway contractors, for the building of the viaduct across the rivers Dee and Ceiriog, on the Shrewsbury and Chester Railway. That supply was obtained from loose boulders on the Berwen range of mountains, just above the village of Llansaintfraidd Glyn Ceiriog. I believe I discovered another very large supply lately on the Kerry-hills, in Montgomeryshire.

It is a very impure limestone, containing much clay in its substance, and to this it owes its peculiar properties. All limestones contain more or less of alumina in their composition, and it is this skeleton of alumina which forms the rottenstone of commerce, after all the calcareous portion has been removed. This removal is effected by nature, by means of some as yet unexplained chemical action, and the hard heavy limestone is converted into a substance as light as cork, and resembling in colour and appearance the brown powder of a ripe puff ball.

Shortly before the death of my lamented friend, the late Professor Johnston, of Durham, I made a tour with him into Wales, in order to examine this curious substance in situ, but unfortunately death prevented the publication of the results of his interesting researches. The rottenstone occurs in large masses on the outskirts of the limestone band in the Brecon Hills, and may be there seen in all its stages of transformation.

In case any of the chemical or geological readers of the *Journal* should feel inclined to take up the subject of the rottenstone, I may say that one of the best places for seeing it with which I am acquainted is about two miles from the "Lamb and Flag" inn, near Ystradgynlais, in the Swansea valley. It is there collected in quantity for exportation to London, and the principal dealer lives close to the "Lamb and Flag."

I may add that the Swansea valley itself is worth a pilgrimage to any lover of grand mountain scenery.

I am, &c.,
JOHN GIRDWOOD.

49, Pall Mall, Nov. 11, 1856.

Proceedings of Institutions.

◆

Crosby Hall Evening-Classes.—Mr. Leone Levi, the professor of banking and commercial law, has been engaged to deliver a course of six lectures on the principles of banking, in Crosby Hall, Bishopsgate-street, before the Young Men's Evening Classes, to commence on the second Tuesday in January. It is probable that Mr. Levi will deliver the same course of lectures before the members of some other literary and scientific institutions in London and the vicinity.

Epsom and Ewell.—The Committee of the Literary and Scientific Institution, in presenting the fifth annual report, express their regret that the expenditure has exceeded the income of the year to the amount of

£21 14s. 10d., two-thirds of which deficiency is attributable to the lectures, but they believe that a little more assistance from the members would relieve them from this difficulty in future, and with this hope of co-operation they have made arrangements for an interesting succession of lectures and lecture-entertainments during the session just commenced. Some additions have been made to the library, and the number of books issued to members has been 717. Although a diminution has taken place in the number of honorary members, the Committee congratulate themselves on the large addition to another class,—the quarterly subscribers—the list at the end of September, 1856, exhibiting an increase of at least one-half more than the number shewn at the corresponding period of 1855.

MACCLESFIELD.—The Twenty-first Anniversary of the Society for Acquiring Useful Knowledge was held on Tuesday the 11th inst., at the Town-hall, the president of the Society, John Brocklehurst, Esq., M.P., in the chair. There was a numerous attendance on the occasion, and among the company present were E. C. Egerton, Esq., M.P., E. W. Wilmott, Esq., and Samuel Greg, Esq. After an address from the president, the secretary read the report, which states that the subscribers, both honorary and ordinary, have increased, and the library has been still further extended, by an addition of about 175 volumes. The classes are still numerously and diligently attended, the reports of the teachers being very satisfactory, and arrangements have been made for re-opening the French class. The Rev. Dr. Newbold kindly gave a lecture on the Coliseum at Rome; and Mr. Walter Montgomery, in May and December, gave two of his Dramatic Recitations. The progress of the Society, since its establishment, has been very considerable. In 1855, it had an income, from all sources, of about £80; a reference library of about 20 volumes, but no circulating library. It had about twelve honorary and ninety ordinary members. Now it has an income of £700, a reference and circulating library of about 3,100 volumes, about 300 honorary and 300 ordinary members, and it has a large and commodious building of its own, with two public news and reading-rooms, and the Government School of Design is accommodated within its walls. E. C. Egerton, Esq., M.P., Samuel Greg, Esq., the Mayor of Macclesfield, the Rev. C. A. J. Smith, J. N. Brocklehurst, Esq., E. W. Wilmott, Esq., the Rev. Alexander Taylor, and other gentlemen then addressed the meeting. In the course of the proceedings the distribution of prizes to students in the classes took place.

MEETINGS FOR THE ENSUING WEEK.

MON. Royal Institution, 2. General Monthly Meeting.
Royal, 4. Anniversary.
Royal Institution, 7. Professor Odling, "On Organic Chemistry."
Architects, 8.
Chemical, 8. I. Dr. Williamson, F.R.S., "On some Reactions in Organic Chemistry." II. Mr. A. G. Anderson, "On the Saponification of Resin."
Entomological, 8.
TUES. Civil Engineers, 8. Mr. T. T. Jopling "On Recent Improvements in Water Meters."
Linnæan, 8.
Pathological, 8.
WED. London Institution, 3. Professor Rymer Jones, "On Vivaria and their Inhabitants."
Society of Arts, 8. Mr. Christopher Binks, "On some New Methods of Treating Linseed Oil and other Oils, for Improving their Drying and other Properties, in their Application to Paints and Varnishes."
Geological, 8. Captain Spratt, F.R.S. and G.S. "On the Freshwater Formations of the Grecian Archipelago." Several Papers on Volcanic Eruptions, Earthquakes, &c.
THURS. London Institution, 7. Dr. R. E. Grant, "On the Natural History of Extinct Animals."
Antiquaries, 8.
Philological, 8.
Photographic, 8.
FRI. Archæological Institution, 4.
SAT. Asiatic, 2.
London Institution, 3. Mr. T. A. Malone, "On Experimental Physics, chiefly in Relation to Chemistry."
Medical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November* 21*st*, 1856.]

Dated 13*th September*, 1856.

2145. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in firearms. (A communication.)

Dated 19*th September*, 1856.

2200. Archibald Templeton, 7, Skinner-street, and John Lawson, Glasgow—Improvements in the manufacture of pile fabrics.
2206. John Underwood and Frederic Valentine Burt, Fish-street-hill—The manufacture of copying-inks for printing.

Dated 29*th September*, 1856.

2276. Richard Boycott, Blaina, Aberystruth, Monmouth—An improved air-door.

Dated 14*th October*, 1856.

2401. John Knowles, jun., St. Helens, Lancashire—An improved apparatus for the prevention of accidents in winding from mines, which apparatus is also applicable for other similar purposes.

Dated 1*st November*, 1856.

2565. Peter Smith and Thomas Irvine, Liverpool—Improvements in the masts, yards, and rigging of ships.

Dated 4*th November*, 1856.

2582. William King Westly, Leeds—An improved method of and machinery for heckling, combing, drawing, and preparing fibrous substances for spinning.

Dated 5*th November*, 1856.

2592. Andre Jacques Isaac de Montenay du Minhy, Blois, France—Improvements in screw hand presses. (A communication.)
2594. Louis Urion, Nancy, France—Improvements in machinery for the manufacture of matches and match boxes.
2596. Charles Titterton, Roehampton—Improvements in the manufacture of zinc and zinc white.
2598. William Edward Newton, 66, Chancery-lane—Improvements in steam-engines. (A communication.)
2600. Herbert Keeling, King and Queen Iron Works, Rotherhithe—An improvement in rivetting fish joints and other parts in the permanent way of railways.
2602. William Brindley, Moorgate-street—Improvements in the preparation of paper-hangings and other ornamental papers.
2604. John Stanley, 244, Whitechapel-road—Improvements in the construction of, and mode of applying, cranes and other machines to hoisting, suspending, and lowering purposes, also in generating, transmitting, and applying motive power to the same.
2605. William Seed, Preston, Lancashire, and William Ryder, Bolton-le-Moors—Improvements in certain parts of machinery for slubbing and roving cotton and other fibrous materials.
2606. Frederic Holdway, Bayswater—Improvements in the manufacture of candles.
2607. William Blackwell, Settle, Yorkshire — Improvements in ploughs.
2608. Mannor Browne, Strand—Certain improvement in shirts.
2609. George Collier, Halifax—Improvements in drying, stretching and polishing or finishing yarns.

Dated 6*th November*, 1856.

2610. George Henry Stevens, 14, Stafford-row, Pimlico, and Robert Fitch, South Lambeth—Improvements in locking and unlocking jars, bottles, and other vessels, and making such vessels air-tight.
2611. Joseph La Cabra, Albany-street—Improvements in the action of pianofortes.
2612. Colin Hunter, Islandreagh, Antrim, Ireland—Improvements in effecting the operations of drying, heating, and ventilating.
2613. Joseph Parker, Blackburn, Lancashire—Certain improvements in machinery or apparatus for roasting coffee, or for other similar purposes.
2614. William Henry Olley, 2, Brabant-court, Philpot-lane—Improvements in obtaining photographic impressions or pictures of microscopic objects.
2615. James Webster, Birmingham—A new or improved instrument or apparatus for transmitting hydrostatic and pneumatic pressure, which said instrument or apparatus is applicable to pressure-guages, safety valves, thermometers, and other like machines.
2616. Peter Cato, John Miller, jun., and John Audley, Brunswick-dock, Liverpool—Improvements in the manufacture of ships' knees.
2617. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of cranked axles and shafts. (A communication.)
2618. Frederic Chapman, Piccadilly, and Charles Bowyer, Davies-street—A method of purifying and disinfecting intestines. and manufacturing gelatine therefrom.

Dated 7*th November*, 1856.

2619. Henry Dircks, Moorgate-street—Improvements in the preparation and application of the materials for making worts and washes in brewing, distilling, and like operations, and in the apparatus connected with the same.
2620. Alexander Porecky, Hackney—Improvements in the construction of safety match or lucifer boxes.
2621. Thomas Ollis, jun., Liverpool—Improvements in machinery or apparatus for cutting paper, card-board, mill-board, scale-board, leather, and other substances of a light nature.

2622. William Spence, 50, Chancery-lane—Improvements in apparatus used in the manufacture of silk and other fibrous materials. (A communication.)

2623. Joseph Louis Casartelli, Manchester, and Anthony Casartelli and Louis Casartelli, Liverpool—Certain improved apparatus for ascertaining the density of water in marine steam boilers or generators, for the purpose of preventing saline incrustation.

2625. Louis Joseph Victor Vuitton, Paris—An improved apparatus for consuming smoke.

Dated 8*th November*, 1856.

2626. James Dickinson, Blackburn—Improvements in machinery or apparatus used in the preparation of cotton or other fibrous substances for spinning.

2627. George Bertram, Edinburgh, and William McNiven, Polton Mill, Lasswade—Improvements in the manufacture of paper.

2628. Lawford Huxtable, 56, Saint Michael's-hill, Bristol—Improvements in pianofortes.

2629. William Porter, 9, Lansdowne-villas, Brompton—Improvements in the grinding of cements and other substances, and in the construction of millstones for the same.

2631. Charles Vaughan, William James Vaughan, and Richard Vaughan, Birmingham—A new or improved strap or band for working stamps, raising weights, and transmitting power generally.

2622. Archibald Reid, Sidmouth-street—Improvements in treating iron, so as to render it impervious to continuous oxidation.

2633. William Morphet, Leeds—Improvements in producing the velvet pile and Witney finish in cloths, and in machinery or apparatus for the same

2635. Jean Baptiste Edouard Victor Alaux, 2, Rue St. Etienne, Bonne Nouvelle, Paris—A lubricating composition.

2636. Thomas Walker, Balderstone, Rochdale—An improved method of lubricating the interior of the cylinders of steam engines for reducing the friction of the pistons thereof.

2637. Richard Archibald Brooman, 166, Fleet-street—Improvements in preserving provisions. (A communication.)

2638. Richard Archibald Brooman, 166, Fleet-street—Improvements in machinery for cutting and dressing stone, marble, and similar materials. (A communication.)

Dated 10*th November*, 1856.

2639. Henry Bessemer, 4, Queen-street-place—Improvements in the manufacture and treatment of iron, and in the manufacture of steel.

2640. Edwin Thomas Dolby, Stratford-place, Camden-town—Improvements in printing several colours at one time from a single stone, plate, or block.

2641. Andrew Barlow, Shirley, Hants—Improvements in mashing apparatuses.

2642. François Jules Manceaux and Eugene Napoleon Vieillard, Paris—An improvement in breech-loading fire-arms and ordnance.

2643. William Stones, Greenhithe—An improved mode of sizing paper.

2644. Peter Gaskell, Sculcoates, Kingston-upon-Hull—The admission of steam into the cylinders of steam engines by an equilibrium valve.

2645. James Somerville, Glasgow—Improvements in weaving.

2646. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in apparatus for printing electro-telegraphic despatches. (A communication.)

2647. Richard Pearcy, Manchester—Improvements in machinery or apparatus for giving additional cohesiveness and torsion to fibrous substances in the drawing and other processes.

Dated 11*th November*, 1856.

2648. William Smith, 10, Salisbury-street, Adelphi—Improvements in machinery for sewing cloth and other materials. (A communication.)

2649. John Fell Jones, Birmingham—Improvements in the manufacture of rollers or cylinders for printing fabrics, and in machinery to be used in manufacturing the said rollers or cylinders.

2650. William Clark, 53, Chancery-lane—Improvements in the manufacture of barytes and strontian, and their salts, and in their application to various purposes. (A communication.)

2651. Richard Archibald Brooman, 166, Fleet-street—Improvements in the manufacture of boots and shoes, and other like articles. (A communication.)

2652. James Leadbetter, Leeds—Improved means of obtaining motive power.

2653. Francis Frederick Clossman, 16A, Park-lane—Obtaining alcohol from certain substances not hitherto used for that purpose. (A communication.)

2654. Paul Rapsey Hodge, 4, Albion-grove, Barnsbury-park—Improvements in the manufacture of felted cloth. (A communication.)

2655. Hugh Baines, Manchester—Improved machinery or apparatus to be applied to hoisting and other lifting machines.

2656. John Henry Johnson, 47, Lincoln's-inn-fields—Improvements in projectiles. (A communication.)

2657. Julian Bernard, the Albany, Piccadilly—Improvements in the manufacture or production of boots and shoes, or coverings for the feet, and in the machinery or apparatus employed in such manufacture.

Dated 12*th November*, 1856.

2659. William Lukyn, senr., Broad-street, Nottingham—A buffer break for railway carriages or trucks attached to locomotive engines, whether one or more engines, for the conveyance of goods or passengers.

2661. William Weild, Manchester—Improvements in machinery for doubling, twisting, and winding yarns or threads on to bobbins or spools.

2663. Henry Collett, 12, Grosvenor-street, St. Peter's-street, Islington—Improvements in machinery for mowing and reaping.

2665. Arthur Maw, Broseley, Salop—An improved mode of constructing the eccentrics or cams of steam engines and other machinery.

2667. Jean Charles Boulay, 34, Rue des Bernardins, Paris—An improved method of printing in various colours simultaneously.

2669. Richard Archibald Brooman, 166, Fleet street—A new or improved felted fabric. (A communication.)

2671. William Green, junr., and Thomas Storey, Framwell Gate Colliery, near Durham—Improvements in machinery or apparatus for washing or cleaning coal.

Dated 13*th November*, 1856.

2673. Thomas Wright Gardener Treeby, 1, Westbourne-terrace-villas, Westbourne-terrace North—Forming sewers or tunnels, and gulleys to sewers.

2675. Alexander Hutton, Ardwick, near Manchester—An improved warming apparatus, applicable to railway and road carriages, and other useful purposes.

2677. Samuel Newington, Ticehurst, Sussex—Improvements in dibbling apparatus.

2679. William Francis and James Hooper, 88, Leadenhall-street—Improvements in tanning and dyeing leather, linen, cotton, wool, hair, and silk, and fabrics composed of any of these substances.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2720. William Healy, 118, Dorset-street, Salisbury-square—Improvements in furnaces and boilers and hot water apparatus for heating purposes.—18th November, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed November 21*st*, 1856.

1244. William Illingworth.

1250. Benj. Nadault de Buffon.

1277. Oldham Whittaker and Cyrus Wallwork.

1281. William Carr Hutton.

1285. Adolphe Bonvallet.

1321. Raymond Fletcher and Edwin Fletcher.

1325. Thomas Morris.

1418. Edouard Guérin.

1707. William Astbury Jump.

1972. George James Farmer.

2021. Hezekiah Conant.

2125. Richard Atkinson Coward.

2139. George Hutchison.

2180. George Davies.

2218. William Taylor.

Sealed November 25*th*.

1260. Samuel Newington.

1270. Lemuel D. Owen.

1274. Charles Herbert Holt.

1298. Thomas Wilson.

1300. Stephen Rossin Parkhurst.

1304. Augustin Marie Herland.

1324. Joseph Briggs.

1328. William Potts.

1352. Thomas Chambers, jun.

1382. William Wilson.

1552. James Fleming, jun.

1592. William Colborne Cambridge.

1856. Thomas Evans, jun.

1938. Henry Bessemer.

2102. Charles Brook, jun.

2124. Pier Alberto Balestrini.

2250. Robert Frost.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID

November 17*th*.

2679. William Taylor.

2683. Patrick Benignus O'Neill.

2684. John Harcourt Brown.

2625. Emanuel Wharton.

2714. Frederick Levick and Joseph Fieldhouse.

2808. George Collier.

November 18*th*.

2689. Auguste Castets.

2691. William Austin.

2716. Charles Ramsay.

November 20*th*.

2706. William Joyce and Thomas Meacham.

2740. Daniel Lancaster Banks.

2800. James Reilly.

November 21*st*.

2619. Benjamin Burleigh.

2729. John Drumgoole Brady.

2737. Samuel Cunliffe Lister.

2745. William Leigh Brook and Charles Brook, jun.

2747. John Henry Johnson.

November 22*nd*.

2723. John Hill, sen., and John Hill, jun.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
3906	Nov. 20.	Clover Leaf Consolidator, and Wire-worm Exterminator or Clod-crusher	John Large	Upton, Berks.
3907	„ 21.	A Jointed Stay for Casement Windows, Doors, &c.	Abercrombie and Son...........	19, John-st. Tottenham-court-road.